

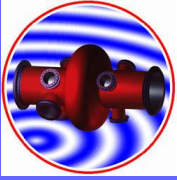
Possible Assembly and Test of the Crab cryomodule in SM18 at CERN

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LHC Crab Cav meeting, 17 Sep' 09



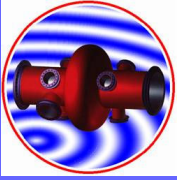
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SM18 Presentation



- 2 x 15 meters grey-white room with rail
- 1 canopy for pieces conditioning
- 2 horizontal radiation-safe bunkers
 - First one fed by 352 MHz 300kW cw klystron
 - Second one fed by 400 MHz 300kW cw klystron
 - But :
 - Demineralized water capacity a bit short for parallel operation
 - Not equipped for 2 Kelvin
 - Limited Cryogenics availability



Transport

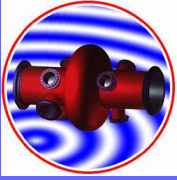


- Transport from pumping after last cavity rinsing under vacuum
- Need to develop a bogie system for the cryomodule assembly in clean room
- As transport of the fully equipped cryostat is more critical than a single bare cavity, let's do the assembling and final test here at CERN
- Transfer from SM18 to PT4 at low speed with G shock logging system

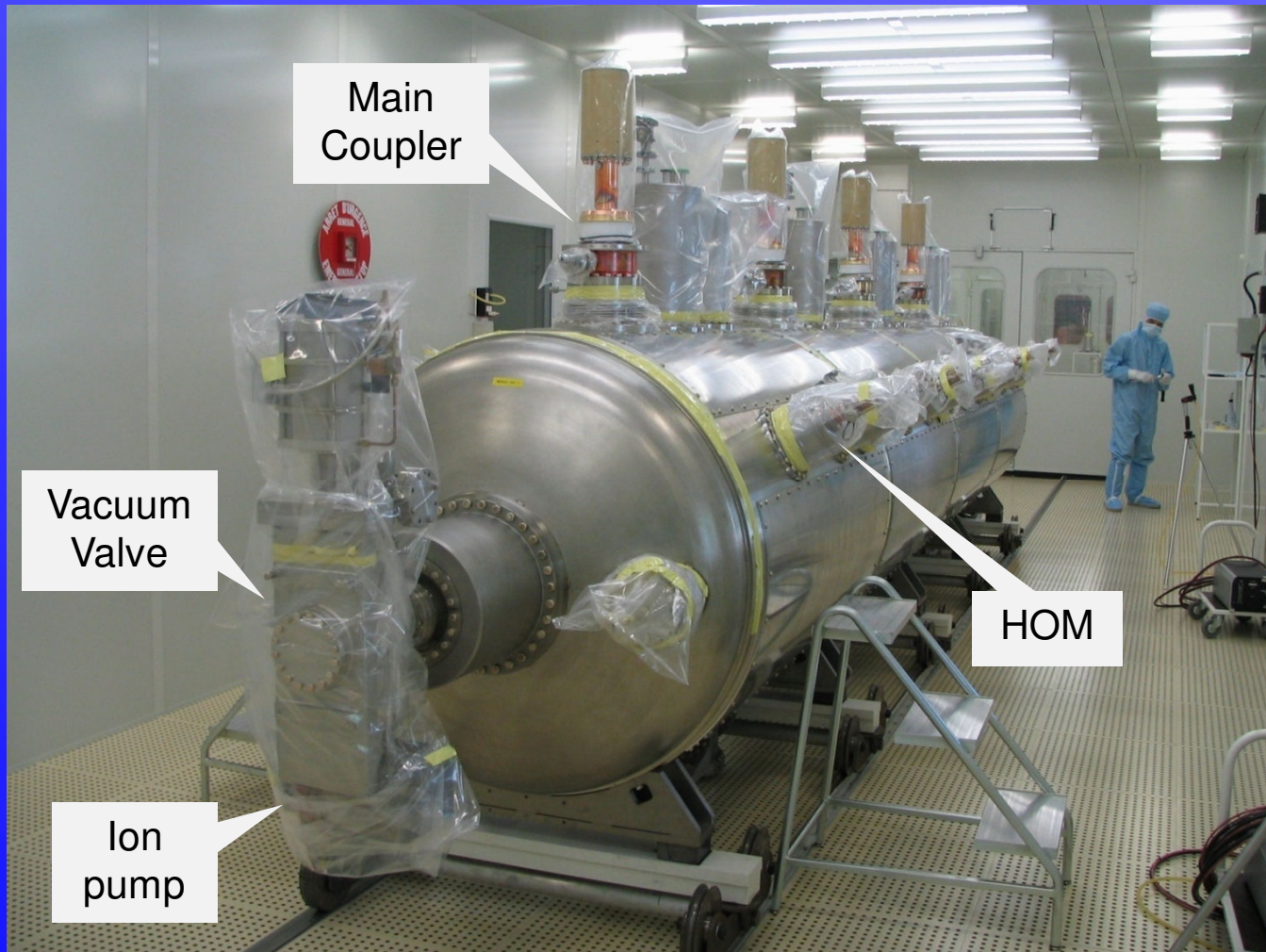
Rail & supporting frame



Assembly in clean room



- 30 meters long in 2 x 15 meters Class 1000 then 10



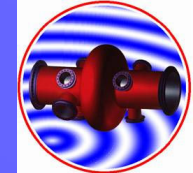


Vacuum connection & leak detection

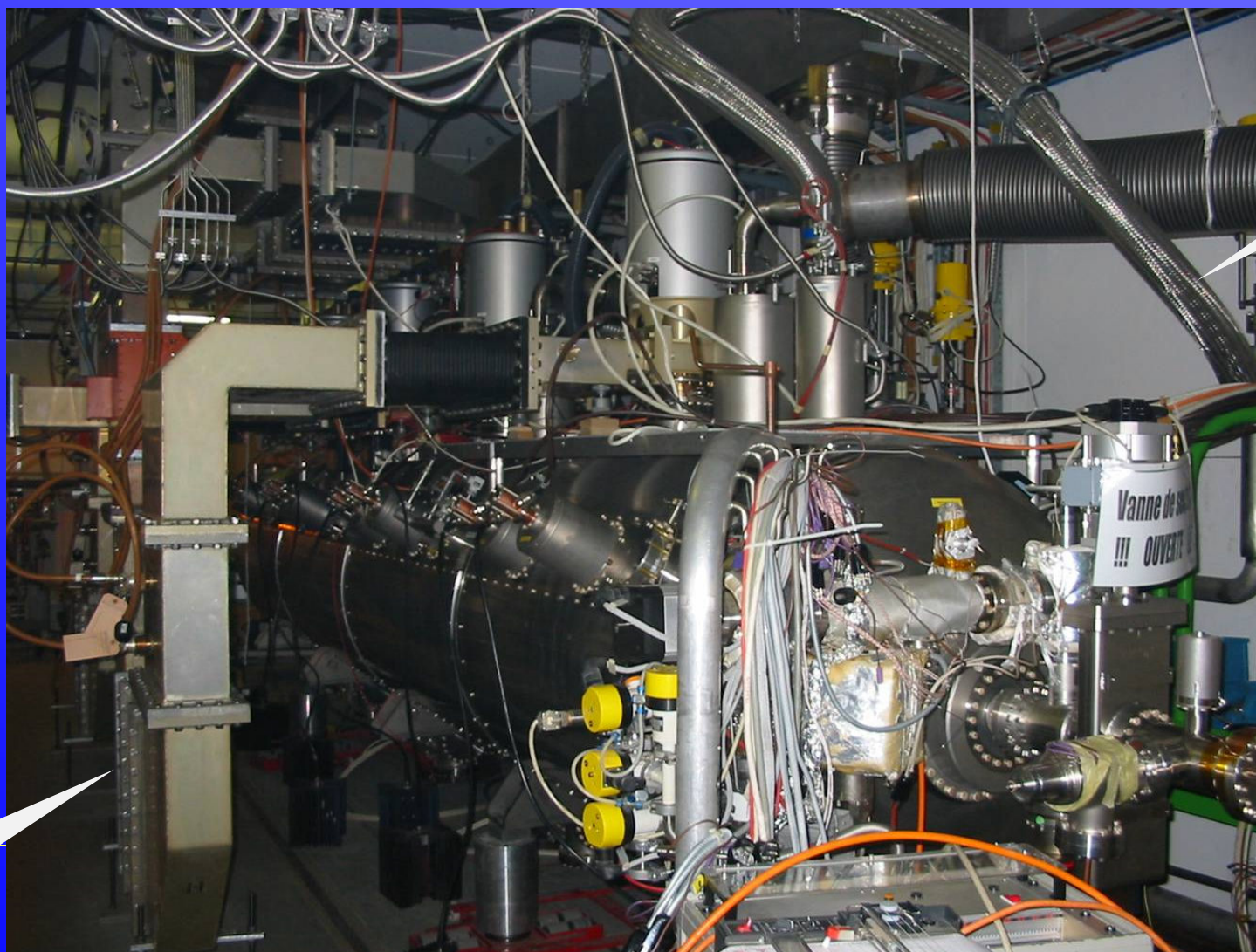


- As for the vertical test great care for the vacuum manipulations is mandatory !
 - Low speed oil free vacuum pumping system
 - Each operation in clean room followed by pumping and leak detection
 - All metallic joints around cold parts
 - Penning gauge near coupler

Horizontal Bunkers



- Transfer of modules to radiation safe bunker
- Connections with cryogenic lines, RF, controls, e- stoppers



RF From
Klystron

He gas
return

Electron
Stopper

Wave
Guide



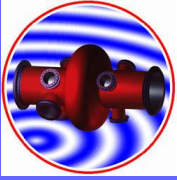
Cool down & Warm up



- Cryo operation became difficult with ageing ABB control interface and ageing instrumentation...
- As
 - We share the He distribution with the LHC magnet test stand (2000 elements in machine) !
 - Since spring 2007 the SM18 cryo-plant capacity went down to 22 g/sec
 - Old RF transfer line consumes already 8 g/sec...
- There is a limited cryogens availability for SC serial tests !



Low power measurements



- Loaded Q, tuning range, HOMs measurements
- Antenna calibration
- And before power feeding
- Dedicated Interlocks installation & full check
 - Main couplers very sensible !
 - Remember : in case of ceramic break down, pollution of the whole module to be dismantled !
 - Fast RF shut off with vacuum increase, arc detection in WG, He pressure raise, RP alarm, RF zone access etc.



Conditioning up to max field



Read and Display

Pulse

Power [kW]

Ig Pulse

Time samples (depend on the pulse length)

Voltage [mV]

Accelerating Voltage Pulse

Time samples (depend on pulse length)

PULSE SETTINGS

Start Pulse Length: U5_200

End Pulse Length: CW

Power [kW]

Envelope Ig & Acceleration Voltage

Time pulses (20ms)

SETTINGS

Envelope Rise Time

Envelope Flat top

Envelope Fall Time

Min Power: 5, Start Power: 50, End Power: 240

Envelope

Vacuum log10 [hPa]

Vacuum Maximum Envelope

Time pulses (20ms)

Voltage Limit: 4

Vacuum limit: -7

Vacuum Gain: 16

Vacuum Offset: -7

Pulse Tail Delay [u5]: 0 to 100

Send Settings

Send Setting

Power [kW]

Vacuum & attenuation

Time count

RF SETTINGS

Central Frequency [Hz] 1: 4.00702E+8

Sweep Range [Hz] 1: 5000

Sweep Frequency [Hz] 1: 9

Output Level [dB] 1: 0

Central Frequency [Hz] 2: 4E+8

Sweep Range [Hz] 2: 1E+6

Sweep Frequency [Hz] 2: 10

Output Level [dB] 2: -20

SWAP STATUS

RF ON

80MHz PLL

Faults

RF Ext Veto

VME-BP Veto

RF Soft Veto

RF Saturation

Configuration

Running

DDS STATUS

RF ON

Env Ramp Run

Env Ramp UP

Lock LO

Lock125MHz

Lock50MHz

RFON Disable

IRQ Error

Vac > Limit

Vac Veto

Long Term

Vacuum log10 [hPa]

Vacuum Maximum long

Time envelope count

Device

ALLCondDDS5B1

Time: 2/8/2008 8:58:53 AM

Refresh Settings

FESA Error: Successful

Last power loop #: 3

Wait Hours: 5

Pulse Length: 30m [S]

Current Power: 240k [W]

START

PAUSE

STOP

QUIT

Field & power

Vacuum & attenuation



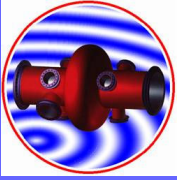
Summary & Conclusion



- Assembly is possible in SM18 clean rooms
- BUT for the power validation
- The Cryo-installation must be upgraded if operation at 2 kelvin (as documented in FP7 proposal Dec 2007)
- Need to buy and install an 800 MHz 60 kW cw RF amplifier beside the 400 MHz klystron
- (Quid of the new SPS 800 MHz amplifier ?)



Summary & Conclusion



- As the 352 MHz bunker will be modified into pulse mode to be used for Linac 4 and SPL study at 704 MHz
- Although the 400 MHz test stand must be kept in good shape for the LHC life time !
- Crab cryomodule will have to share the LHC horizontal test Stand -> to be discussed